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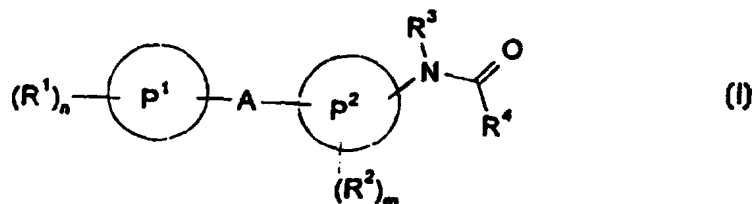
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(54) Title: INDOLE DERIVATIVES AS 5-HT RECEPTOR ANTAGONIST

(57) Abstract

Prodrugs of 5HT_{2C} receptor antagonists of formula (I) wherein the prodrug has a quaternary ammonium group, in particular a quaternary pyridinium group.



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INDOLE DERIVATIVES AS 5-HT RECEPTOR ANTAGONIST

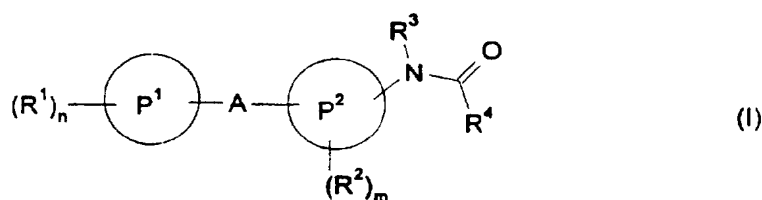
This invention relates to compounds having pharmacological activity, processes for their preparation, to compositions containing them and to their use in the treatment of CNS disorders.

Compounds having 5HT_{2C} receptor antagonist activity are known in the art. For example PCT/EP96/00368 discloses indoline derivatives as 5HT_{2C} antagonists.

However certain 5HT_{2C} receptor antagonists exhibit poor solubility which may lead to decreased activity. It has now been found that pyridinium derivatives of certain known 5HT_{2C} receptor antagonists show increased solubility and increased *in vivo* activity. It is believed that these new compounds are converted to their 'parent' compounds prior/during/or after absorption and so may increase the bioavailability of the 'parent' compound. The compounds of the invention may therefore act as prodrugs and are defined as prodrugs herein.

The present invention therefore provides, in a first aspect, a prodrug of a 5HT_{2C} receptor antagonist wherein the prodrug has a quaternary ammonium group, in particular a quaternary pyridinium group.

Preferably the invention provides a compound of formula (I):



wherein:

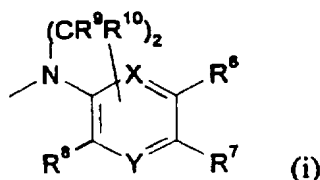
R¹ and R² groups are each independently hydrogen, C₁₋₆ alkyl optionally substituted by NR¹²R¹³, C₂₋₆ alkenyl, C₂₋₆ alkynyl, C₁₋₆ alkylthio, cyano, nitro, halogen, CF₃, C₂F₅, NR¹²R¹³, CONR¹²R¹³, NR¹²COR¹³, S(O)_pNR¹²R¹³, CHO, OCF₃, SCF₃, COR¹⁴, CH₂OR¹⁴, CO₂R¹⁴ or OR¹⁴ where p is 1 or 2 and R¹², R¹³ and R¹⁴ are independently hydrogen, C₁₋₆ alkyl, optionally substituted aryl or optionally substituted arylC₁₋₆alkyl, or R¹ and R² are N⁺I⁻R¹²R¹³CR¹²R¹³OCOR¹⁴ where R¹², R¹³ and R¹⁴ are as defined above and I is a counter ion;

n and m are independently 0, 1 or 2;

R³ is hydrogen or C₁₋₆ alkyl;

R⁴ is a group of formula (i):

5

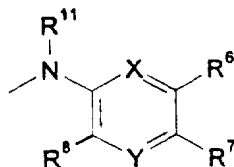


in which:

X and Y are both nitrogen, one is nitrogen and the other is carbon or a CR⁵ group or one is a CR⁵ group and the other is carbon or a CR⁵ group;

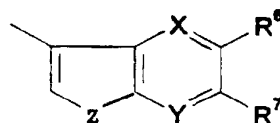
- 10 R⁵, R⁶, R⁷ and R⁸ groups are independently hydrogen, C₁₋₆ alkyl optionally substituted by one or more fluorine atoms, C₂₋₆ alkenyl, C₃₋₆ cycloalkyl, C₃₋₆ cycloalkylC₁₋₆alkoxy, C₂₋₆ alkynyl, C₃₋₆ cycloalkyloxy, C₃₋₆ cycloalkyl-C₁₋₆ alkyl, C₁₋₆ alkylthio, C₃₋₆ cycloalkylthio, C₃₋₆ cycloalkyl-C₁₋₆ alkylthio, C₁₋₆alkoxy, hydroxy, halogen, nitro, OCF₃, SCF₃, SO₂CF₃, SO₂F, formyl, C₂₋₆ alkanoyl, cyano, optionally substituted phenyl or thienyl, NR¹²R¹³, CONR¹²R¹³ or
- 15 CO₂R¹⁴ where where R¹², R¹³ and R¹⁴ are as defined for R¹; or R⁶ and R⁷ form part of an optionally substituted 5- or 6-membered carbocyclic or heterocyclic ring; R⁹ and R¹⁰ are independently hydrogen or C₁₋₆ alkyl; or R⁴ is a group of formula (ii):

20



- 25 in which X and Y are both nitrogen, one is nitrogen and the other is a CR⁵ group or X and Y are both CR⁵ groups and R⁵, R⁶, R⁷ and R⁸ are as defined in formula (I); and R¹¹ is hydrogen or C₁₋₆ alkyl, or

R⁴ is a group of formula (iii):



5

(iii)

in which R⁶, R⁷, X and Y are as defined in formula (i) and Z is O, S, CH₂ or NR¹⁵ where R¹⁵ is hydrogen or C₁₋₆ alkyl;

P¹ and P² are independently phenyl, aromatic or partially saturated monocyclic or bicyclic heterocyclic rings said heterocyclic rings containing a quaternary nitrogen atom and up to two further heteroatoms selected from nitrogen, oxygen or sulphur; and

A is a bond, a chain of 1 to 5 atoms optionally substituted by C₁₋₆ alkyl or A is an optionally substituted phenyl or an optionally substituted 5- to 7-membered heterocyclic ring containing up to three heteroatoms selected from nitrogen, oxygen or sulphur.

C₁₋₆ Alkyl groups, whether alone or as part of another group, may be straight chain or branched.

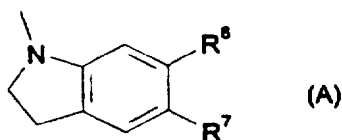
Suitably R¹ and R² groups are each independently hydrogen, C₁₋₆ alkyl optionally substituted by NR¹²R¹³, C₂₋₆ alkenyl, C₂₋₆ alkynyl, C₁₋₆ alkylthio, cyano, nitro, halogen, CF₃, C₂F₅, NR¹²R¹³, CONR¹²R¹³, NR¹²COR¹³, S(O)_pNR¹²R¹³, CHO, OCF₃, SCF₃, COR¹⁴, CH₂OR¹⁴, CO₂R¹⁴ or OR¹⁴ where p is 1 or 2 and R¹², R¹³ and R¹⁴ are independently hydrogen, C₁₋₆ alkyl, optionally substituted aryl or optionally substituted arylC₁₋₆alkyl, or R¹ and R² are N⁺X⁻R¹²R¹³CR¹²R¹³OCOR¹⁴ where R¹², R¹³ and R¹⁴ are as defined above and X is a counter ion. Examples of suitable aryl groups include phenyl. Examples of suitable arylC₁₋₆alkyl groups include benzyl.

Preferably R¹ is hydrogen or methyl.

Preferably R² is hydrogen, halogen, methyl, CF₃ or OCF₃, most preferably R² is hydrogen, halogen or methyl.

Preferably R³ is hydrogen.

Preferably R^4 is a group of formula (i). Preferably X and Y form part of a phenyl ring, that is to say one of X or Y is carbon and the other is a CH group or both of X and Y are CH groups. Most preferably R^4 is a group of formula (A):



5

in which R^6 and R^7 are as defined in formula (i).

Suitably R^6 and R^7 groups are independently hydrogen, C_{1-6} alkyl optionally substituted by one or more fluorine atoms for example CF_3 or C_2F_5 ,

- 10 C_{2-6} alkenyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkoxy, C_{2-6} alkynyl, C_{3-6} cycloalkyloxy, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylthio, C_{3-6} cycloalkylthio, C_{3-6} cycloalkyl- C_{1-6} alkylthio, C_{1-6} alkoxy, hydroxy, halogen, nitro, CF_3 , C_2F_5 , OCF_3 , SCF_3 , SO_2CF_3 , SO_2F , formyl, C_{2-6} alkanoyl, cyano, optionally substituted phenyl or thienyl, $NR^{12}R^{13}$, $CONR^{12}R^{13}$ or CO_2R^{14} where R^{12} , R^{13} and R^{14} are
- 15 as defined for R^1 ; or R^6 and R^7 form part of an optionally substituted 5- or 6-membered carbocyclic or heterocyclic ring. Examples of such rings include cyclopentane and dihydrofuran rings.

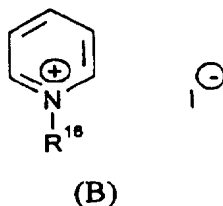
Preferably R^6 is trifluoromethyl or halogen and R^7 is C_{1-6} alkoxy, in particular methoxy, C_{1-6} alkylthio, in particular methylthio or C_{1-6} alkyl in particular

20 methyl.

Suitably n and m are independently 0, 1 or 2. Preferably n is 0 or 1.

Suitably P^1 and P^2 are independently phenyl, aromatic or partially saturated monocyclic or bicyclic heterocyclic rings containing a quaternary nitrogen atom and up to two further heteroatoms selected from nitrogen, oxygen or sulphur. Preferably

25 P^1 and/or P^2 is a quaternary group of formula (B)



where R¹⁶ is C₁₋₆ alkyl, C₁₋₆ alkoxy, oxygen, NR¹⁷R¹⁸, NHCONR¹⁷R¹⁸, NHCOR¹⁹, CR¹⁷R¹⁸OCOR¹⁹, OCR¹⁷R¹⁸OCOR¹⁹, CR¹⁷R¹⁸OCONR¹⁷R¹⁸, or OCR¹⁷R¹⁸OCONR¹⁷R¹⁸ where R¹⁷, R¹⁸ and R¹⁹ are independently hydrogen,
 5 C₁₋₂₀ alkyl, optionally substituted aryl or optionally substituted arylC₁₋₆alkyl and I⁻ is a counter ion.

More preferably P¹ is a group of formula (A) where R¹⁶ is CR¹⁷R¹⁸OCOR¹⁹. Most preferably R¹⁷ and R¹⁸ are both hydrogen. Preferred counter ions include halogen such as chloro or iodo.

10 P² is preferably phenyl or pyridyl.

The urea moiety can be attached to a carbon or any available nitrogen atom of the ring P², preferably it is attached to a carbon atom. Suitable moieties when the ring P² is a 5-membered aromatic heterocyclic rings include isothiazolyl, isoxazolyl, thiadiazolyl, oxadiazolyl and triazolyl. Suitable moieties when the ring P² is a 6-
 15 membered aromatic heterocyclic rings include, for example, pyridyl, pyrimidyl or pyrazinyl. Optional substituents for P¹ and P² groups include those groups R¹ and R² listed above.

Suitably A is a bond or a chain of 1 to 5 atoms optionally substituted by C₁₋₆ alkyl. Examples of such chains include (CH₂)_pE or E(CH₂)_p where p is 1 to 4
 20 and E is CO, O, S(O)_x where x is 0 to 2 or A is NR, CONR, NRCO, NRCONR, CO, CH(OH), C₁₋₆alkyl, CH=CH, CH=CF, CF=CF, O, S(O)_x where x is 1 or 2, NR, or NRSO₂ where R is hydrogen or C₁₋₆ alkyl. Preferably A is a bond or a group CH₂O, OCH₂, or O. Most preferably A is a bond or O.

Suitably A is an optionally substituted phenyl group or an optionally
 25 substituted 5- or 6-membered heterocyclic ring containing up to three heteroatoms selected from nitrogen, oxygen or sulphur. Preferably A is thiazolyl, isothiazolyl, oxazolyl, isoxazolyl, thiadiazolyl, triazolyl, pyridyl, pyrimidyl or pyrazinyl. Most preferably A is thiazolyl. Optional substituents when A is a phenyl or a heterocyclic group include those groups R¹ and R² listed above

30 Particular compounds of the invention include:

5-Methoxy-6-trifluoromethyl-1-[3-fluoro-5-[1-(acetyloxy)methyl-pyridinium-3-yl]phenylcarbamoyl]indoline chloride,

5-Methoxy-6-trifluoromethyl-1-[3-fluoro-4-methyl-5-[1-(acetyloxy)
methylpyridinium-3-yl]phenylcarbamoyl]indoline chloride,

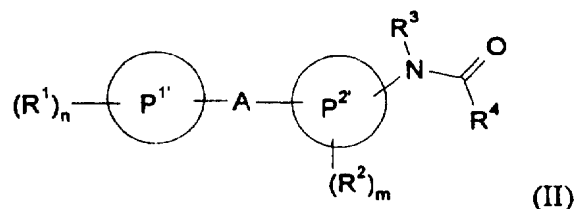
5,6-Dichloro-1-[6-[1-(acetyloxy)methyl-2-methylpyridinium-3-yl-oxy] pyridin-3-
ylcarbamoyl]indoline, and

- 5 5-Methoxy-6-trifluoromethyl-1-[3,4-difluoro-5-[1-(acetyloxymethyl)pyridinium-3-
yl]phenylcarbamoyl] indoline chloride.

Certain compounds of formula (I) are capable of existing in stereoisomeric
forms including enantiomers and the invention extends to each of these stereoisomeric
forms and to mixtures thereof including racemates. The different stereoisomeric
10 forms may be separated one from the other by the usual methods, or any given isomer
may be obtained by stereospecific or asymmetric synthesis. The invention also
extends to any tautomeric forms and mixtures thereof.

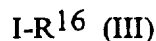
The present invention also provides a process for the preparation of a
compound of formula (I) or a pharmaceutically acceptable salt thereof, which process
15 comprises

- (a) for compounds of formula (I) where P¹ and/or P² are a group of formula (A) or
(B) reaction of a compound of formula (II):



20 in which A, R¹, R², R³, R⁴, n and m are as defined in formula (I) and P^{1'} and P^{2'} are
independently phenyl, aromatic or partially saturated monocyclic or bicyclic
heterocyclic rings containing up to three heteroatoms selected from nitrogen, oxygen
or sulphur, with a compound of formula (III):

25



in which R¹⁶ is as defined in formula (I) and I is a leaving group.

The reaction of compounds (II) and (III) is preferably carried out in an inert solvent such as acetonitrile in the presence of a boron coupling reagent such as tetraphenylboron. Preferably I is a leaving group such as halogen.

Those skilled in the art will appreciate that it may be necessary to protect
5 certain reactive groups in compounds of formulae (II) and (III) during the coupling reaction. Suitable protecting groups and methods for their attachment and removal are conventional in the art of organic chemistry, such as those described in Greene T.W. 'Protective groups in organic synthesis' New York, Wiley (1981).

Compounds of formula (I) and their pharmaceutically acceptable salts have
10 5HT_{2B/2C} receptor antagonist activity and are believed to be of potential use for the treatment or prophylaxis of CNS disorders such as anxiety, depression, epilepsy, obsessive compulsive disorders, migraine, Alzheimers disease, sleep disorders, feeding disorders such as anorexia and bulimia, panic attacks, withdrawal from drug abuse such as cocaine, ethanol, nicotine and benzodiazepines, schizophrenia, and also
15 disorders associated with spinal trauma and/or head injury such as hydrocephalus. Compounds of the invention are also expected to be of use in the treatment of certain GI disorders such as IBS as well as microvascular diseases such as macular oedema and retinopathy.

Thus the invention also provides a compound of formula (I) for use as a
20 therapeutic substance, in particular in the treatment or prophylaxis of the above disorders.

The invention further provides a method of treatment or prophylaxis of the above disorders, in mammals including humans, which comprises administering to the sufferer a therapeutically effective amount of a compound of formula (I).

25 In another aspect, the invention provides the use of a compound of formula (I) in the manufacture of a medicament for the treatment or prophylaxis of the above disorders.

The present invention also provides a pharmaceutical composition, which comprises a compound of formula (I) and a pharmaceutically acceptable carrier.

30 A pharmaceutical composition of the invention, which may be prepared by admixture, suitably at ambient temperature and atmospheric pressure, is usually adapted for oral, parenteral or rectal administration and, as such, may be in the form

of tablets, capsules, oral liquid preparations, powders, granules, lozenges, reconstitutable powders, injectable or infusable solutions or suspensions or suppositories. Orally administrable compositions are generally preferred.

5 Tablets and capsules for oral administration may be in unit dose form, and may contain conventional excipients, such as binding agents, fillers, tableting lubricants, disintegrants and acceptable wetting agents. The tablets may be coated according to methods well known in normal pharmaceutical practice.

10 Oral liquid preparations may be in the form of, for example, aqueous or oily suspension, solutions, emulsions, syrups or elixirs, or may be in the form of a dry product for reconstitution with water or other suitable vehicle before use. Such liquid preparations may contain conventional additives such as suspending agents, emulsifying agents, non-aqueous vehicles (which may include edible oils), preservatives, and, if desired, conventional flavourings or colourants.

15 For parenteral administration, fluid unit dosage forms are prepared utilising a compound of the invention or pharmaceutically acceptable salt thereof and a sterile vehicle. The compound, depending on the vehicle and concentration used, can be either suspended or dissolved in the vehicle. In preparing solutions, the compound can be dissolved for injection and filter sterilised before filling into a suitable vial or ampoule and sealing. Advantageously, adjuvants such as a local anaesthetic, 20 preservatives and buffering agents are dissolved in the vehicle. To enhance the stability, the composition can be frozen after filling into the vial and the water removed under vacuum. Parenteral suspensions are prepared in substantially the same manner, except that the compound is suspended in the vehicle instead of being dissolved, and sterilization cannot be accomplished by filtration. The compound can 25 be sterilised by exposure to ethylene oxide before suspension in a sterile vehicle. Advantageously, a surfactant or wetting agent is included in the composition to facilitate uniform distribution of the compound.

30 The composition may contain from 0.1% to 99% by weight, preferably from 10 to 60% by weight, of the active material, depending on the method of administration.

 The dose of the compound used in the treatment of the aforementioned disorders will vary in the usual way with the seriousness of the disorders, the weight

of the sufferer, and other similar factors. However, as a general guide suitable unit doses may be 0.05 to 1000 mg, more suitably 0.05 to 20.0 mg, for example 0.2 to 5 mg; and such unit doses may be administered more than once a day, for example two or three a day, so that the total daily dosage is in the range of about 0.5 to 100 mg; and
5 such therapy may extend for a number of weeks or months.

When administered in accordance with the invention, no unacceptable toxicological effects are expected with the compounds of the invention.

The following Descriptions and Examples illustrate the preparation of compounds of the invention.

10

Example 1**5-Methoxy-6-trifluoromethyl-1-[3-fluoro-5-[1-(acetyloxy)methyl-pyridinium-3-yl]phenylcarbamoyl]indoline chloride (E1)**

5 To a solution of 5-methoxy-6-trifluoromethyl-1-[3-fluoro-5-(pyridin-3-yl)phenylcarbamoyl]indoline (0.5g, 1.16 mmol) in acetonitrile (20 ml) was added sodium tetraphenylboron (0.48g, 1.40 mmol) followed by bromomethyl acetate (0.14 ml, 1.43 mmol). The resulting mixture was heated at reflux under argon for 4 h, then cooled to room temperature, and filtered through a kieselgühr pad. The filtrate was
10 concentrated to give the pyridinium tetraphenylborate salt as a yellow solid which was taken-up in acetonitrile/2-propanol (20 ml; 1:1 v/v) and passed through an ion-exchange column (2 x 10 cm of Dowex 1x2 chloride, 50-100 mesh) at ca. 1 ml/min. The eluant was concentrated, and the resulting solid was triturated with diethyl ether to give after drying the title compound (E1) as a yellow solid (0.63g, 100%) m.p. 145-
15 150°C.

¹H NMR (400 MHz; DMSO) δ: 2.18 (3H, s), 3.29 (2H, t, J=8Hz), 3.85 (3H, s), 4.27 (2H, t, J=8Hz), 6.50 (2H, s), 7.24 (1H, s), 7.44 (1H, m, J=10Hz), 7.72 (1H, m, J=11Hz), 8.09 (1H, s), 8.14 (1H, s), 8.34 (1H, dd, J=11Hz, 7Hz), 8.99 (1H, d, J=10Hz), 9.23 (2H, m), 9.59 (1H, s).
20

Mass spectrum (FAB) 504 (M⁺).

Example 2

25 **5-Methoxy-6-trifluoromethyl-1-[3-fluoro-4-methyl-5-[1-(acetyloxy)methylpyridinium-3-yl]phenylcarbamoyl]indoline chloride (E2)**

5-Methoxy-6-trifluoromethyl-1-[3-fluoro-4-methyl-5-(pyridin-3-yl)phenylcarbamoyl]indoline (0.195g, 0.44 mmol) was converted to the title compound (E2)
30 according to the method of Example 1 to give a yellow solid (0.23g, 95%) m.p. 212-4°C.

¹H NMR (250 MHz; DMSO) δ: 2.12 (3H, m), 2.17 (3H, s), 3.28 (2H, t, J=8Hz), 3.84 (3H, s), 4.22 (2H, t, J=8Hz), 6.49 (2H, s), 7.22 (1H, s), 7.60-7.70 (2H, m), 8.10 (1H, s), 8.36 (1H, dd, J=8Hz, 7Hz), 8.82 (1H, d, J=9Hz), 9.11 (1H, s), 9.28 (1H, d, J=5Hz), 9.49 (1H, s).

5

Mass spectrum (FAB) 518 (M⁺).

Example 3

5,6-Dichloro-1-[6-[1-(acetyloxy)methyl-2-methylpyridinium-3-yl-oxy] pyridin-3-ylcarbamoyl]indoline chloride (E3)

10

5,6-Dichloro-1-[6-(2-methylpyridin-3-yloxy)pyridin-3-ylcarbamoyl]indoline (0.25g, 0.6 mmol) was treated with bromomethyl acetate and sodium tetraphenylboron at reflux in acetonitrile (15 ml) for 10 h according to the procedure described in Example 1 to give the title compound (E3) (0.26g, 80%) m.p. 125-135°C which contained approximately 15% starting material as an off-white solid.

15

¹H NMR (200 MHz; DMSO) δ: 2.17 (3H, s), 2.79 (3H, s), 3.20 (2H, t, J=8Hz), 4.22 (2H, t, J=8Hz), 6.53 (2H, s), 7.32 (1H, d, J=9Hz), 7.49 (1H, s), 8.02 (1H, s), 8.08 (1H, dd, J=8Hz, 6Hz), 8.20 (1H, dd, J=9Hz, 3Hz), 8.38 (1H, d, J=3Hz), 8.56 (1H, d, J=8Hz), 9.06 (1H, d, J=6Hz), 9.12 (1H, s).

20

Example 4

5-Methoxy-6-trifluoromethyl-1-[3,4-difluoro-5-[1-(acetyloxymethyl)pyridinium-3-yl]phenylcarbamoyl] indoline chloride (E4)

25

5-Methoxy-6-trifluoromethyl-1-[3,4-difluoro-5-(pyridin-3-yl)phenylcarbamoyl]indoline (0.30g, 0.67 mmol) was converted into the title compound (E4) according to the method of Example 1. The tetraphenylborate salt was stirred with Dowex 1x8-200 ion-exchange resin in 1:1 acetonitrile/2-propanol (25 ml) for 24 h. The resin was then filtered off and the filtrate evaporated to give the title compound (0.35g, 94%), mp 201-2°C.

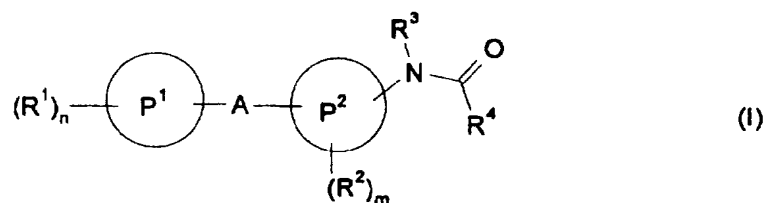
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^1H NMR (250 MHz; D_6DMSO) δ : 2.17 (3H, s), 3.29 (2H, t, $J=8\text{Hz}$), 3.84 (3H, s), 4.25 (2H, t, $J=8\text{Hz}$), 6.51 (2H, s), 7.23 (1H, s), 7.89 (2H, m), 8.12 (1H, s), 8.39 (1H, t, $J=7\text{Hz}$), 8.96 (1H, d, $J=7\text{Hz}$), 9.27 (1H, s), 9.32 (1H, d, $J=7\text{Hz}$), 9.52 (1H, s).

5 Mass Spectrum (FAB) 522 (M^+).

Claims

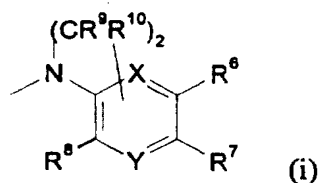
1. A compound of formula (I):



5

wherein:

- R^1 and R^2 groups are each independently hydrogen, C_{1-6} alkyl optionally substituted by $NR^{12}R^{13}$, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkylthio, cyano, nitro, halogen, CF_3 , C_2F_5 , $NR^{12}R^{13}$, $CONR^{12}R^{13}$, $NR^{12}COR^{13}$, $S(O)_pNR^{12}R^{13}$, CHO , OCF_3 , SCF_3 , COR^{14} , CH_2OR^{14} , CO_2R^{14} or OR^{14} where p is 1 or 2 and R^{12} , R^{13} and R^{14} are independently hydrogen, C_{1-6} alkyl, optionally substituted aryl or optionally substituted aryl C_{1-6} alkyl, or R^1 and R^2 are $N^+I^-R^{12}R^{13}CR^{12}R^{13}OCOR^{14}$ where R^{12} , R^{13} and R^{14} are as defined above and I is a counter ion;
- n and m are independently 0, 1 or 2;
- 15 R^3 is hydrogen or C_{1-6} alkyl;
- R^4 is a group of formula (i):

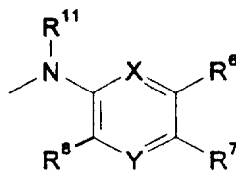


- 20 in which:

- X and Y are both nitrogen, one is nitrogen and the other is carbon or a CR^5 group or one is a CR^5 group and the other is carbon or a CR^5 group;
- R^5 , R^6 , R^7 and R^8 groups are independently hydrogen, C_{1-6} alkyl optionally substituted by one or more fluorine atoms, C_{2-6} alkenyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl C_{1-6} alkoxy, C_{2-6} alkynyl, C_{3-6} cycloalkyloxy, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylthio, C_{3-6} cycloalkylthio, C_{3-6} cycloalkyl- C_{1-6} alkylthio,
- 25

C₁₋₆alkoxy, hydroxy, halogen, nitro, OCF₃, SCF₃, SO₂CF₃, SO₂F, formyl, C₂₋₆ alkanoyl, cyano, optionally substituted phenyl or thienyl, NR¹²R¹³, CONR¹²R¹³ or CO₂R¹⁴ where where R¹², R¹³ and R¹⁴ are as defined for R¹; or R⁶ and R⁷ form part of an optionally substituted 5- or 6-membered carbocyclic or heterocyclic ring;

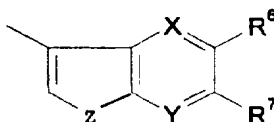
- 5 R⁹ and R¹⁰ are independently hydrogen or C₁₋₆ alkyl; or
R⁴ is a group of formula (ii):



10 (ii)

in which X and Y are both nitrogen, one is nitrogen and the other is a CR⁵ group or X and Y are both CR⁵ groups and R⁵, R⁶, R⁷ and R⁸ are as defined in formula (I); and R¹¹ is hydrogen or C₁₋₆ alkyl, or

- 15 R⁴ is a group of formula (iii):



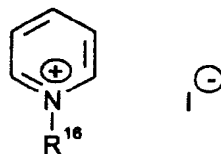
(iii)

- 20 in which R⁶, R⁷, X and Y are as defined in formula (i) and Z is O, S, CH₂ or NR¹⁵ where R¹⁵ is hydrogen or C₁₋₆ alkyl;

P¹ and P² are independently phenyl, aromatic or partially saturated monocyclic or bicyclic heterocyclic rings containing a quaternary nitrogen atom and up to two further heteroatoms selected from nitrogen, oxygen or sulphur; and

- 25 A is a bond, a chain of 1 to 5 atoms optionally substituted by C₁₋₆ alkyl or A is an optionally substituted phenyl or an optionally substituted 5- to 7-membered heterocyclic ring containing up to three heteroatoms selected from nitrogen, oxygen or sulphur.

2. A compound according to claim 1 where P¹ is a group of formula (B):



(B)

- 5 where R¹⁶ is C₁₋₆ alkyl, C₁₋₆ alkoxy, oxygen, NR¹⁷R¹⁸, NHCONR¹⁷R¹⁸, NHCOR¹⁹, CR¹⁷R¹⁸OCOR¹⁹, OCR¹⁷R¹⁸OCOR¹⁹, CR¹⁷R¹⁸OCONR¹⁷R¹⁸, or OCR¹⁷R¹⁸OCONR¹⁷R¹⁸ where R¹⁷, R¹⁸ and R¹⁹ are independently hydrogen, C₁₋₂₀ alkyl, optionally substituted aryl or optionally substituted arylC₁₋₆alkyl and I⁻ is a counter ion.

10

3. A compound according to claim 1 or 2 where P² is phenyl or pyridyl.
4. A compound according to any one of claims 1 to 3 where R⁴ is a group of formula (A).

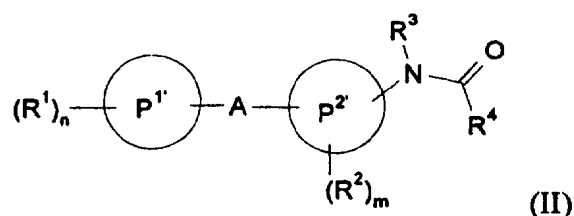
15

5. A compound according to any one of claims 1 to 4 which is:
- 5-Methoxy-6-trifluoromethyl-1-[3-fluoro-5-[1-(acetyloxy)methyl-pyridinium-3-yl]phenylcarbamoyl]indoline chloride,
- 5-Methoxy-6-trifluoromethyl-1-[3-fluoro-4-methyl-5-[1-(acetyloxy)methylpyridinium-3-yl]phenylcarbamoyl]indoline chloride,
- 20 5,6-Dichloro-1-[6-[1-(acetyloxy)methyl-2-methylpyridinium-3-yl-oxy]pyridin-3-ylcarbamoyl]indoline, or
- 5-Methoxy-6-trifluoromethyl-1-[3,4-difluoro-5-[1-(acetyloxymethyl)pyridinium-3-yl]phenylcarbamoyl] indoline chloride.

25

6. A compound according to any one of claims 1 to 5 for use in therapy.
7. A pharmaceutical composition comprising a compound according to any one of claims 1 to 5 and a pharmaceutically acceptable excipient.

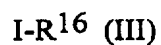
8. A process for preparing a compound of Claim 1 in which R is substituted alkyl which comprises reacting a compound of a compound of formula (II):



5

in which A, R¹, R², R³, R⁴, n and m are as defined in Claim 1 and P^{1'} and P^{2'} are independently phenyl, aromatic or partially saturated monocyclic or bicyclic heterocyclic rings containing up to three heteroatoms selected from nitrogen, oxygen or sulphur, with a compound of formula (III):

10



in which R¹⁶ is as defined in Claim 1 and I is such that I⁻ is a leaving group.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 97/01611

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 C07D401/12 A61K31/44 C07D401/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 94 22871 A (SMITHKLINE BEECHAM PLC ;FORBES IAN THOMSON (GB); MARTIN ROGER THOM) 13 October 1994 see the whole document ---	1,3,6,7
X	WO 94 04533 A (SMITHKLINE BEECHAM PLC ;FORBES IAN THOMSON (GB); MARTIN ROGER THOM) 3 March 1994 see the whole document ---	1,3,4,6, 7
X	WO 92 05170 A (BEECHAM GROUP PLC) 2 April 1992 see the whole document ---	1,3,6,7

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

15 July 1997

Date of mailing of the international search report

2 9. 07. 97

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De Jong, B

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 97/01611

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE CROSSFIRE Beilstein XP002001373 BRN=2955290 & DE-A-2955290	1,3
X	--- DATABASE CROSSFIRE Beilstein XP002001374 BRN=3419367 & JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 79, 1957, DC US, pages 1236-1242, BEAVER ET AL.:	1,3
X	--- DATABASE CROSSFIRE Beilstein XP002001375 BRN=2138496 & TETRAHEDRON LETTERS, 1970, OXFORD GB, page 4905 GRUPON ET AL.:	1,3
P,X	--- WO 96 23783 A (SMITHKLINE BEECHAM PLC ;GASTER LARAMIE MARY (GB); WYMAN PAUL ADRIA) 8 August 1996 see the whole document -----	1-8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/EP 97/01611

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
Claims 1 and 3 are so broad that a complete search was not possible for economical reasons. Only a few examples of novelty destroying documents have been cited in the search report.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 97/01611

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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WO 9404533 A	03-03-94	AU 4704693 A CA 2142721 A CN 1086819 A EP 0656003 A JP 8500580 T NZ 254785 A SI 9300438 A ZA 9306050 A	15-03-94 03-03-94 18-05-94 07-06-95 23-01-96 26-09-95 31-03-94 20-02-95
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WO 9623783 A	08-08-96	AU 4664696 A	21-08-96